GLAST Science Analysis Software – Tools & Utilities
Version 1: 2000/05/17

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Introduction

At the 2000/05/15-17 meeting for off-line software at SLAC, we compiled a list of "tools" necessary and/or desirable for doing science analysis. This list is not complete, but represents a good start at identifying the essential programs. These tools fall into three broad categories: I. Primitives, II. Utilities, and III. Calibrations. Calibrations is futher subdivided into Tracker, Calorimeter, and Anti-Coincidence Detector, plus PSF measurements.

Except for the set of primitive tools developed by Pat Nolan, none of these programs exist yet for use in GLAST science analysis environment. However, good precursors or analogues exist in some cases (as noted in descriptions).

In most cases under "Utilities," the detailed requirements relevant to GLAST are not established, and so will need further consideration by the program author and advisors. However, the utilities for GLAST may be easily built upon existing analogues (e.g., "SkyView," now being rewritten in Java at the HEASARC). Whereas for "Calibrations," the train of calibration steps has been discussed several times for the tracker and calorimeter, as detailed in the powerpoint presentations from January 2000, by Robert Johnson and Eric Grove. The appropriate programming languages (C++, Java, Root, IDL, etc.) need to be more widely discussed.

People who have "signed up" (or are already working) to lead implementation of tools or advise on implementation are listed in brackets. The next step for each tool will be establishment of specific requirements, including input and output parameters, and relationships between modules – such as other tools and higher level science analysis algorithms. Then we should consider realistic schedules for implementation.

ITEM {Responsible person(s)} STATUS

I. Primitives

1. Transformers for enforcing Standardized Units {P. Nolan} — 2000/05 – First draft
   a. Dimensioned scalars { time (intervals), angles, energy }
   b. Coordinates { time, position }
   c. sky, pixels

II. Utilities

1. Event getter – gets whole event: high-level descriptors from SPD, whole detector response and reconstruction {Dubois assignment}

2. Item getter – gets specified piece of data from event {Dubois assignment}

3. Reader (FITSIO equivalent) – gets set of events, given query {Dubois assignment}

4. Event display – displays whole event, detector information & reconstruction {Dubois assignment, H. Arrighi}

5. Database – query generator {H. Arrighi}

6. Improved “SkyUtil” (also: W3Browse) – specify position & radius, program outputs included objects found in catalogs {J. Silvis}

ITEM {Responsible person(s)} STATUS

II. Utilities (continued)

7. Map utilities {S. Digel, P. Nolan, Y.C. Lin, J. Silvis}
   a. exposure maps
   b. resampler (binner upper)
   c. smoother
   d. projector
   e. addmap

8. Timeliner {C. Meetre}
   a. lists times when GLAST observed a region
   b. given point on sky, ⇒ {distance of closest approach, time, angle}
   c. predictor for items in b.

9. Workhorse display tool, a la: Tom McGlynn's "SkyView," {J. Bonnell, H. Arrighi}
   Hans' map display, and the EGRET "SkyMap"

ITEM {Responsible person(s)} STATUS

III. Calibrations

1. Tracker {T. Usher, L. Rochester}
   a. calculate strip occupancy
   b. manage / update strip masks
   c. enable threshold changes in Front End Electronics (⇒ FSW)
   d. monitor Level-1 trigger rate (MO & FSW)
   e. relate HSK information to strip/trigger performance
   f. measuring strip alignment: perform ground survey, provides baseline;
      analyze "straight-throughs", estimating alignment & efficiency
   g. compute actual positions for given strip relative to instrument axes
   h. simulate misalignment of {towers, trays, detectors}
   i. revisit "charge-sharing" among strips

2. Calorimeter (Eric Grove's "Seven Steps to Calorimetry") {E. Grove}
   a. reader raw data – "root2idl.pro"
   b. subtract pedestals – "subtract_pedestals.pro"
   c. apply non-linearity corrections – "ACD_to_fC.pro"
      (accounts for electronic effects;
      output is charge at preamp input)
   d. apply gain corrections – "fC_to_MeV.pro"
      (accounts for optical contact, "e_per MeV"
      ⇒ MeV deposited, per diode & gain range)
   e. select best gain range – "range_to_use.pro"
   f. calculate layer sums and total sum – "layersum.pro"
   g. fit shower profile – "calfit.pro"

ITEM {Responsible person(s)} STATUS

III. Calibrations (continued)

3. ACD system {H. Arrighi}
   a. combine charge deposition for "straight-throughs" with trajectory to realize calibrated measurement for path length in tiles
   b. monitor routine for ACD's redundant electronics (i.e., the rates for redundant electronic chains per tile; actually relevant to MO & FSW, recorded here for time being)

4. Sensitivity and PSF Monitoring {J. Norris, P. Nolan, S. Digel}
   Over entire range of inclination angles need to simulate, and calibrate in-flight, the "fisheye effect" (see section E.5 in "Summary of Requirements for Science Analysis Software")